SYMONS'S
MONTHLY
METEOROLOGICAL MAGAZINE.

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TRUE TIME.

WE believe that there has been during the last 20 years a marked increase in the attention bestowed by meteorological observers on the accurate timekeeping of their clocks and watches. But we are convinced that there is room for much further improvement. For instance, we do not believe that more than one observer out of twelve could state with certainty and accuracy the precise minute at which he reads this line. There would be mental discussion. "Well, my watch was two minutes fast when I was at the station on Monday, and so it ought to be about right now," or "Oh, the Hall clock gains about three minutes a week, and as this is Saturday, it must be three minutes fast." Forgetting that as the said clock in all probability has an iron rod from its pendulum, the rate of gain depends on the temperature. How many observers keep a regular record of the errors of their clocks or watches? A few do, but scarcely one in twenty.

We do not like repetition, but as we hold this matter to be one of great importance, we purpose reprinting portions of various articles and letters which have appeared in this Magazine in the hope that the collective arguments and facts may have greater force than anything that we could say.

The first article which we quote shows that from the gross inaccuracy of the records of the time of the earthquake of October, 1868, it was impossible to determine its point of central action, although records were obtained from 71 stations.

EARTHQUAKE OF OCTOBER 30TH.

"If anyone wanted evidence of the prevailing ignorance as to correct time—we do not mean time true to seconds or tenths of a second, but correct to a minute—he would be abundantly supplied by the last earthquake, which we believe really occurred at 10 35 p.m., but which is reported to have been felt at all sorts of times within half an hour thereof. We put the subject prominently forward, because we think many observers are not so careful as they should be to have some one clock or watch about the correctness of which there should be no doubt. Let us give just one instance of the necessity of so doing, and an instance which will bring us back to our subject. Earthquake shocks travel at the rate of about 14 miles per minute, therefore as the shock was felt at Pembroke and Blackheath (210 miles apart), and at Liverpool and Torquay (200 miles apart), it is abundantly clear that if the times had been taken with

any approach to correctness, we should have known considerably more about the shock then we now do. For instance, if it was a surface shock travelling S to N., it should have been a quarter of an hour earlier at Torquay than at Liverpool, and of course the time should get gradually later at intervening stations, instead of which it is irregular in the extreme. The theory has been propounded that these last earthquakes have their origin not in the ordinary subterranean regions of volcanic fires, but much nearer the surface, in the explosion of large accumulations of gas in the coal measures. If this were the case, the time would have varied considerably, in circles, having the site of explosion for their common centre; but, as we have before stated, the recorded times are so discordant as to be of very little use. If we could have relied upon their being within three or four minutes of correct, we might have done something in the matter."—*Meteorological Magazine*, Nov., 1868.

A remarkably fine meteor was seen in the early evening of November 6th, 1869; we received thirty or forty accounts of it, the real time at which it occurred was, we believe, 6·52 p.m., but the times quoted were dreadfully discordant, ranging from 6·30 to 7 p.m. This, jointly with the receipt of a copy of Mr. Warner's book "*How to keep the Clock right*," led to the insertion of the following article:—

TRUE TIME: HOW TO GET IT AND HOW TO KEEP IT.

"The extreme inconsistency exhibited by the numerous accounts of the meteor, which we publish and comment upon elsewhere, must plead our excuse, if any be needed, for referring to horological matters in a publication devoted to meteorology; but many cases will occur to observers in which correctness of time is of the first importance; rate of progress of earthquake shocks, and particular gusts of wind, identity of luminous meteors, and a score of other facts lose all their value if some clocks are right and some are wrong—and the majority are wrong, more or less. Nor is this much to be wondered at, for there is hardly a town in England in which two watchmakers (watch-*menders* is a more proper term) have shops with so called "regulators" conspicuously placed therein and marked on the dial "Greenwich Mean Time," which said regulators will not differ by *several minutes*. We willingly exclude some few, who, by the equipment of small observatories and other means, secure accuracy worthy of high praise, and where one such firm exists in a town, the owners of such shops as we refer to generally copy them, and ofttimes secure the credit. We write of the majority, and recognise a few honourable exceptions. Even in London, where several clocks are actually controlled from Greenwich, errors of many minutes are by no means rare; and in country towns matters are worse. Hence it is clear, either that there is some great difficulty in "keeping the clock right," or that the very people whose business character ought to be imperilled by themselves, of all people, not knowing "what's o'clock," must be excessively negligent. We incline to the latter opinion because telegraphic communication has now been extended to most towns, and an approximation to true time may generally be obtained from the telegraph clerks. If therefore the provincial tradesmen neglect so simple a mode of keeping near the mark, we cannot acquit them of negligence. But with private observers living at a distance from telegraph stations, and communication with centres of population, the case is different; they must fall back upon the timepiece in the sky, but how are they to read it—by the sun alone? or by any of the glittering host which may be convenient? surely by the latter—but how?

"Here we cross the Rubicon from meteorology to astronomy, and in our further consideration of the question, we shall doubtless exhibit want of familiarity with astronomical matters, but if by so doing we induce those who are therewith connected to come to the help of those who need it, our notice will not be in vain. Let us premise that what we conceive to be required is some apparatus which shall be (1) very simple (both in construction, and in the mode of observing, (2) very durable, (3) low in price,

£2 or £3, (4) which shall give results, not liable to greater errror than 10 seconds, (5) which shall be available for taking time from sun, moon, or stars. From the above it will be evident that we by no means contemplate advising our meteorological readers to engage in costly or difficult astronomical observations, or that we wish for extreme accuracy, and we venture to think that the object is one not utterly beneath the notice of our astronomical readers.

"What means at present exist? The sun-dial, oldest of all chronometers, and one which well made, well and firmly fixed, is not to be despised. Price lists before us indicate that a first-rate sun-dial is charged several guineas, and we never saw one which could be read to anything like the accuracy we mention. Then come dipleidoscopes, a considerable improvement on sun-dials, but in their best and only accurate form also dear. Transit circles have hitherto never been quoted under £10 or £20, so they too must be very much simplified, or excluded from consideration. Jupiter's Satellities are very handy, and as ordinary telescopes, such as most observers possess, will show their phenomena, they involve no outlay, but for several months in each year they are not available.

"What, then, is anyone to do who wishes to keep his clock right? We fear Mr. Warner's book*, recently published, will not tell him, for he expressly states that he has not yet decided on the best form of telescope, but he proposes when that is determined, that it should be rigidly fixed to a perfectly solid pillar, and that it should have wires somewhat like Cary's Portable Transit, but with an improvement, viz., two vertical wires instead of one, and a wooden case to shut over and protect it from weather. There is no intimation of cost, and we venture to think that the instrument is inferior to the portable transit. The author has evidently taken very great pains in preparing the tables appended to the work, which are designed as a substitute for the Nautical Almanack, but we confess we prefer our old friend, the Nautical.

"In conclusion, we venture to hope that some of our astronomical readers, some optician, or some horologist, will tell us how simply, easily, and cheaply to get true time and to keep it."

In subsequent numbers during 1869 and 1870 attention was called to a form of the old meridian dial, and also to Dent's Dipleidoscope. If there should be any considerable demand for an instrument giving time by observations of the *sun only*, and required to be true only within five seconds, we believe that a pattern of meridian dial, fulfilling these conditions, could be brought out by opticians for sale at one guinea.

As regards the meridian dial, we think that it may be of interest to place upon convenient record, that which we believe to be the earliest description of the arrangement in its most simple form. The book seems to be scarce (it is not quoted in the bibliography of English Horological works in the *Horological Journal*) and we, therefore, reprint the title page, as well as the three pages descriptive of the early form of meridian dial.

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* *How to keep the Clock right.* By T. WARNER. Cloth, 8vo, 77 pages. Williams and Norgate.

Horological Disquisitions

Concerning the

NATURE of TIME

AND THE

Reasons why all Days, from Noon to Noon, are not alike Twenty Four Hours long.

In which appears the Impossibility of a Clock's being always kept exactly true to the Sun.

With TABLES of EQUATION, and Newer and Better RULES than any yet extant, how thereby precisely to adjuft ROYAL PENDULUMS, and keep them afterwards, as near as possible to the apparent Time.

With a TABLE of PENDULUMS, shewing the BEATS that any Length makes in an Hour

A Work very necessay for all that would understand the true way of rightly managing Clocks and Watches.

By *JOHN SMITH*, C.M.

To which is added,

The best Rules for the Ordering and Use both of the Quick-Silver and Spirit Weather Glasses: And Mr. *S. Watson's* Rules for adjusting a Clock by the *Fixed Stars*.

LONDON: Printed for *Richard Cumberland* at the *Angel* in *S.* Paul's *Church-Yard*. 1694.

(90)

JUst when the last Sheet was ready to be printed off, that which follows was communicated to me by Mr *Watson*, the Person before-mentioned in this Work, which in respect of its Nature, being not only plain and useful, but also free from all Objections that Tables may be liable to, I have thought fit to add it hereunto, upon his Recommendation, and in the Words penn'd by himself.

SIR.

I *Rather communicate this to you, because many Gentlemen have the Convenience of Places fit for this way of Observation which I take to be the most exact Way yet found to adjust a Pendulum Clock well. If you think it may be serviceable to those that are the most exact and curious in Time-keeping, you may do well to insert it in that laborious and curious Tract of the* Equation of Natural Days, *that you are now publishing. I am,*

Your real Friend
and humble Servant,

S. W.

(91)

The Way of finding how much a Pendulum Clock *has gained or lost in a Day, Week or a Month, to the nicity of Two or Three Seconds, &c.*

N.	h.	′	″	N.	h.	′	″	N.	h.	′	″
1	0	3	56	12	0	47	11	22	1	26	30
2	0	7	52	13	0	51	7	23	1	30	25
3	0	11	48	14	0	55	2	24	1	34	21
4	0	15	44	15	0	58	58	25	1	38	17
5	0	19	39	16	1	2	54	26	1	42	13
6	0	23	35	17	1	6	50	27	1	46	9
7	0	27	31	18	1	10	46	28	1	50	5
8	0	31	27	19	1	14	42	29	1	54	1
9	0	35	23	20	1	18	38	30	1	57	57
10	0	39	19	21	1	22	34	31	2	1	53
11	0	43	15								

TAke a Piece of thin Brass, and file therein a Slit or Notch, about half a quarter of an Inch deep, but somewhat wider at the Top than at the Bottom, as thus knock the End of it into some Post in your Back-side, or else in some Window, that ye think convenient; then look through the Notch at any Star of the first or second Magnitude, and wait till the Star comes to the Edge of any Chimney, or the Side of any House, and you will see the Star vanish in a Moment; then mark what your Clock is at when

when the Star vanishes: Then at any other Night afterwards (as the next Night, or a Week or a Month afterwards) wait for the same Star again till it vanish behind the Chimney or House, as before, and then observe what your Clock is at, then your Clock should shew the second Time of vanishing so much sooner than the first, as this Table shews; now the farther off the Chimney or Wall is the more exact will the Observation be. Let the Distance be Ten Yards at least, let the Observation be made in any part of the *East*, *South* or *West*, but little towards the *North Pole*, because the *Polar Stars* are not so fit for this Purpose.

EXAMPLE.

Suppose a Star vanishes this Night at Nine Hours, Three Minutes and Four Seconds, by my Clock, and Eight Nights after I observe it again, and it then vanishes at Eight Hours, Thirty four Minutes and Forty two Seconds; by my Clock, againft Eight Nights, in the Table, I find Thirty one Minutes Twenty seven Seconds; that is, so much sooner should the Star vanish at the second Observation than it did at the first; therefore substracting 31′ 27″ from the first Observation 9h. 3′ 4″. there's left 8h. 31′ 37″, the true Time that the Clock should have been at in the second Observation; therefore seeing the Clock was then at 8h. 24′ 32″, it has gained 2′ 55″.

FINIS.

During 1870 and 1871, the subject of good and cheap clocks was discussed in these pages, and the discussion was continued in the *Horological Journal* and in the *English Mechanic*, but nothing very satisfactory resulted. The good time-keeping qualities of the clocks known as "Austrian regulators" was pointed out, and Mr. Evans of Mount Street, Grosvenor Square, announced that he had designed and made some clocks such as he considered were required, the cost of which would be £12 each. He thought it unreasonable to expect an accurate timekeeper for any such sum as £5.

For twelve years there has been little progress made except the gradual spread of the postal telegraphs, and of the knowledge that the signal sent by the Royal Observatory at 10 a.m. is forwarded to every telegraph office in England and Wales. These, with the improved supervision of railway station clocks, have undoubtedly made matters far better than they were. In fact, we have a marked proof of progress in a pamphlet just received,* where there are 17 records of the time of an auroral appearance; they all agree within 15 minutes, 58 per cent. of the observations agree within one minute and 82 per cent. within three minutes. In the case of the meteor in 1869 there was a range of 35 minutes between the earliest and latest time quoted, only 38 per cent. agreed within a minute, and only 63 per cent. within three minutes. The 1882 observations were therefore about twice as good as those in 1869.

We are very glad to welcome help towards further accuracy, and we are sure that the energetic way in which Mr. Latimer Clark has taken up the subject will be very effective. We strongly recommend to the notice of our readers the two books† which he has published for the use of those who desire by day or by night to have the means of obtaining time, true to a single second.

Mr. Clark, in his treatise, uses extremely plain language, because, as he says on the title-page, and more fully in the preface, "The book is not designed for the use of physical students of the modern type, but is rather intended for those who, living in the country, have devoted their leisure to pursuits of a widely different character, who know nothing of physical science beyond its name, and who would never dream of opening a book on Astronomy." But Mr. Clark has done more than write these books; he has designed and brought out an extremely solid, durable, and, if we may so say, practicable form of transit instrument at about one-third of the price hitherto charged. In his first work on the subject he states that, having regard to the fact that the cost of transit instruments had prevented their more general use, he had placed himself in communication with

* The Auroral Beam of November 17th, 1882, by J. Rand Capron, F.R.A.S., F.M.S.

† A Treatise on the Transit Instrument, as applied to the determination of time. For the use of country gentlemen. By LATIMER CLARK, M.I.C.E., &c. London: A. J. Frost, 6, Westminster Chambers, S.W. 1882.

Transit Tables for 1883. Same author and publisher.

manufacturing opticians, and had obtained an instrument of high quality, with a 14 in. telescope and $1\frac{1}{8}$ in. aperture for £8, and had arranged for the supply of such instruments by Mr. A. J. Frost, of 6, Westminster Chambers, S.W. Mr. Clark added to this statement that "He will nevertheless endeavour to obtain a still more economical form of instrument, and if successful will publish the result." We sincerely hope that his efforts will not be in vain, for we cannot expect to see a Transit instrument in every rectory until the price is still further reduced.

As regards Mr. Latimer Clark's books, we feel inclined to object to only two matters. We think that in a work expressly designed for amateur use, hundredths of a second are out of place. Tenths of a second are, we think, the extreme limit, if not beyond the limit to which it is possible to go, without all the accessories of a fixed observatory. Secondly, we think that the value for the sun's semi-diameter should be given for every day alongside of, and to the same degree of precision as, the time of the transit of the sun's centre. These, however, are small matters, and on the whole we regard Mr. Latimer Clark as a zealous and able guide towards the universal spreading of true time.

Still, there is much yet remaining to be done; (1) we want some low-priced apparatus that shall give time accurately either from the sun, or preferably from both sun and stars; and (2) we want a clock which shall go within one minute per month, and which also shall be moderate in price. Heretical as horologists will consider the remark, we do not believe that the delicacy of the train or the perfection of the escapement is of much importance. Stout wheels reasonably well made, and an ordinary escapement connected with a well-varnished wooden pendulum, will, we believe, do all that is needed. It seems to us strange if this cannot be provided for £5.

GREENWICH OBSERVATORY.

WE are not aware that the portions of the Report of the Astronomer Royal which relate to Meteorology call for special comment, excepting the three which, for convenience of reference, we have numbered respectively 1, 3, and 6, in the following reprint.

As regards paragraph 1, we are glad to find that the anemometer is being sharply looked after—a thorough examination of the records of great pressures at Greenwich, with regard to the various modifications made in the instrument, would be both of scientific and legal value.

Paragraph 3 seems to prove that the opinion which we have long held, that the area appropriated to temperature observations has been unduly contracted, is correct. We regret to find that what is known as the South ground (to which we should have been glad to see some of the buildings now surrounding the thermometers removed), is now appropriated to an additional telescope. It is a great pity that the ab-

solute integrity of the open space around the thermometer-stand was not respected years ago.

Paragraph 6 indicates a change obviously desirable.

On the whole, we are glad to believe that Mr. Christie recognizes the importance of rigorous continuity and unaltered conditions in the Meteorological Department of the National Observatory.

1. The meteorological instruments and the Thomson electrometer are all in good order. A flexible brass chain has been substituted for the stiff copper wire connecting the pressure plate of Osler's anemometer with the recording pencil. The smaller pressures of ½ lb. and less are now very satisfactorily registered, and as regards the larger pressures, the records hitherto obtained throw some doubt on the results with the copper wire. On the occasion of the gale of 1882 October 24, a velocity of 64 miles an hour was registered with Robinson's anemometer for two successive hours, being greater than any velocity previously recorded here, but the greatest pressure registered with the chain was only 29 lbs. on the square foot, whilst on 1882 April 29 a pressure of 49½ lbs. was recorded with the copper wire, at a time when the velocity was only 50 miles an hour. The stiffness of the copper wire would appear to have exaggerated some of the largest pressures, and to have prevented the record of any of the very small pressures. The pressure scale on the paper was redetermined after the application of the brass chain, and was found to be almost precisely the same as before for large pressures. There were, however, some little differences in the portion of the scale applying to small pressures.

2. The observations of temperature of the Thames have recently been resumed under the charge of the Corporation of London, who have instructed Mr. G. J. Symons to arrange details. The observations are now made at the end of one of the jetties of the Foreign Cattle Market at Deptford, where a record is to be kept (by means of two Six's thermometers) of the daily maximum and minimum temperatures of the Thames at a depth of two feet below the surface, and also near the botton of the river. Mr. Symons has arranged that these observations shall be regularly communicated to the Royal Observatory, to be included in the meteorological table published weekly in the Registrar General's Reports.

3. Comparisons have been made during the past year between the readings of the two pairs of maximum and minimum radiation thermometers when exposed in the Magnetic Ground and South Ground respectively, and also when exposed side by side in the Magnetic Ground (for determination of the differences in their index errors). The general result of these observations is that the solar radiation temperature is somewhat higher in the Magnetic Ground than in the South Ground, and that there is little difference between the terrestrial radiation temperatures in the two situations, though, on the whole, the lowest temperatures are registered in the Magnetic Ground.

4. The mean temperature of the year 1882 was 49°·6, being 0°·1 lower than the average. The highest air temperature was 81°·0 on August 6, and the lowest 22°·2 on December 11. The mean monthly temperature was above the average from January to May, then below until September. In October, November, and December it differed little from the average.

5. The mean daily motion of the air in 1882 was 306 miles, being 27 miles greater than the average. For the month of November the mean daily motion was 449 miles, being 159 miles above the average. The greatest daily motion was 758 miles on November 4, and the least 30 miles on December 11. As already mentioned the greatest hourly velocity was 64 miles an hour, and the greatest pressure (with the chain) 29 lbs. on October 24.

6. During the year 1882 Osler's anemometer showed an excess of 11 revolutions of the vane in the positive direction N., E., S., W., N., if all the turnings are counted (as has been the practice in former years); or of 23 revolutions in the positive direction if the turnings which are evidently accidental are excluded.

7. The number of hours of bright sunshine recorded by Campbell's sunshine

instrument during 1882 was 1245, which is more than 40 hours above the average of the five preceding years.

8. The rainfall in 1882 was 25·2 inches, being very slightly above the average.

9. Certain particulars in regard to the effect of the change in the barometer or thermometer in the course of each month on the monthly values of diurnal inequality as given in the 20 years' Meteorological Reductions have been supplied to Gen. Strachey. Tracings of the Osler anemometer records from 1882 September 1 to November 24 have been made for Mr. G. J. Symons.

10. In regard to the coming year, I may mention one special work of meteorological reductions which it seems desirable to take in hand. The hourly ordinates of barometer and thermometer registers have been read out and tables of mean values formed for the 20 years of the Meteorological Reductions, and also year by year since 1877; but there is a gap of three years for the barometer (1874—1876), and of eight years for the thermometers (1869—1876), for which the photographs have not been discussed. The continuity of the Greenwich series is thus broken, and the results are not available to their full extent. The discussion which I contemplate for the years in question would probably occupy one computer for a year and a half, involving an outlay of about £70.

THE METEOROLOGICAL SOCIETY.

THE usual monthly meeting of this society was held on Wednesday evening, the 16th inst., at the Institution of Civil Engineers, Mr. J. K. Laughton, M.A., F.R.A.S. president, in the chair. F. A. Bellamy, T. A. Mercer, Rev. H. J. Poole, and A. Wise, M.D., were elected Fellows of the Society. The following papers were read :—

1. "Composite portraiture, adapted to the reduction of meteorological and other similar observations," by G. M. Whipple, B.Sc., F.R.A.S. It has often been remarked that one of the main, if not the chief, of the difficulties the meteorologist has to contend with, is the enormous amount of preliminary labour which has to be expended in the not very pleasing task of forming the observations he may wish to discuss into tables, casting the columns of figures so obtained, and then computing the means. With a view of arriving at results by a shorter cut, the author has been led to consider the possibility of employing a method suggested by a consideration of the highly ingenious system of composite portraiture, invented by Mr. Francis Galton, F.R.S., and utilized in his anthropological studies.

2. "Note on Atmospheric Pressure during the Fall of Rain," by H. Sowerby Wallis, F.M.S. The author discusses the condition of atmospheric pressure while rain was falling during 1882, and finds that out of a total of 136 rainy days (which were available for his purpose), on 54 per cent. the rain was accompanied by diminishing pressure, on 27 per cent. by increasing pressure, and on 19 per cent. by steady pressure.

3. "New Method of Reading a Thermometer and Hygrometer at a distance by means of Electricity," by Arthur W. Waters, F.G.S.

4. "An Integrating Anemometer," by W. F. Stanley, F.M.S.

5. "Observations on the Force of the Wind at Sea," by D. W. Barker, F.M.S.

6. "Meteorological Observations at Zanzibar, East Coast of Africa, during 1880 and 1881," by Surgeon-Major C. T. Peters, M.B.

7. "Diurnal Rainfall at Bangkok, Siam," by Capt. G. H. Inskip, F.R.G.S.

RAINFALL OF UBERABA, BRAZIL.

IT is not very often that we quote fragmentary records of foreign rainfall, for if we did, we should soon have our pages filled with nothing else. Moreover, it is far better for the government of each country to publish uniformly all the accurate data obtainable, because then one knows (1) that there is little probability of obtaining any records, unless they are found in the official volume; (2) that observations published therein may be considered as trustworthy.

We do not remember to have seen any such collection of returns for Brazil, and we believe that very few rainfall observations have been made in the interior of that vast country. Therefore, having found in the new American journal, *Science*,* the following returns, we make an exception in their favour.

Uberaba is in the Province of Minas Geraes, in the great watershed of the Paraná, on the high grassy land which divides the basin of the Paraná proper, from that of its great affluent the Rio Grande. Uberaba is in about long. 49° W., lat. 19° S., and its altitude is about 2,500 feet.

The observations were made by Friar Germano.

No information is given as to the position or height of the rain gauge.

	1880.	1881.	1882.
	in.	in.	in.
January	14·17	11·22	11·02
February	13·11	8·90	15·95
March	4·29	5·43	7·09
April	7·13	1·06	4·73
May	·75	·59	2·36
June	·08	·12	2·76
July	·43	·16	1·02
August	·08	·23	3·15
September	2·76	·47	3·82
October	7·48	4·02	4·72
November	10·79	5·59	3·94
December	8·62	11·42	4·92
Total	69·69	49·21	65·48

* [Published weekly at Boston, Mass,, and well worthy of support on both sides of the Atlantic.—ED.]

SUPPLEMENTARY TABLE OF RAINFALL, MAY, 1883.

[For the Counties, Latitudes, and Longitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 10 & 11.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
II.	Dorking, Abinger	2·13	XI.	Llanfrechfa Grange	1·85
,,	Margate, Birchington...	...	,,	Llandovery	2·27
,,	Littlehampton	2·43	,,	Solva	1·28
,,	St. Leonards	2·64	,,	Castle Malgwyn	1·67
,,	Hailsham	3·02	,,	Rhayader, Nantgwillt..	2·18
,,	I. of W., St. Lawrence.	2·54	,,	Carno, Tybrith	1·55
,,	Alton, Ashdell.....	1·74	,,	Corwen, Rhug	1·36
III.	Winslow, Addington ...	1·65	,,	Port Madoc	2·16
,,	Oxford, Magdalen Col...	1·94	,,	I. of Man, Douglas	...
,,	Northampton	1·53	XII.	Carsphairn	3·47
,,	Cambridge, Beech Ho...	1·08	,,	Melrose, Abbey Gate...	1·26
IV.	Southend	1·92	XIII.	N. Esk Res. [Penicuick]	1·35
,,	Harlow, Sheering	1·47	XIV.	Ayr, Cassillis House ..	1·87
,,	Diss	1·43	,,	Glasgow, Queen's Park.	2·03
,,	Swaffham	1·27	XV.	Islay, Gruinart School..	2·89
,,	Hindringham	1·61	XVI.	St.Andrews,NewtonBk.	·73
V.	Salisbury, Alderbury...	1·83	,,	Aberfeldy H.R.S.	1·15
,,	Warminster	2·42	,,	Dalnaspidal	3·69
,,	Calne, Compton Bassett	2·06	XVII.	Keith H.R.S.	2·95
,,	Beaminster Vicarage ...	1·79	XVIII.	Forres H.R.S.	·87
,,	Ashburton, Holne Vic..	2·56	,,	Strome Ferry H.R.S....	3·25
,,	Torrington, Langtree W.	1·92	,,	Lochbroom	3·74
,,	Lynmouth, Glenthorne.	1·26	,,	Tain, Springfield.....	1·41
,,	Probus, Lamellyn	2·33	,,	Loch Shiel, Glenaladale	...
,,	Taunton, Fullands	1·05	XIX.	Lairg H.R.S.	1·57
VI.	Bristol, Clifton	1·58	,,	Forsinard H.R.S.	4·12
,,	Ross	1·72	,,	Watten H.R.S.	2·45
,,	Wem, Sansaw Hall.....	1·73	XX.	Fermoy, Glenville	1·97
,,	Cheadle, The Heath Ho.	·93	,,	Tralee, Castlemorris ...	2·87
,,	Worcester, Diglis Lock	1·09	,,	Tipperary, Henry Street	1·48
,,	Coventry, Coundon	1·79	,,	Newcastle West	2·65
VII.	Melton, Coston	1·92	,,	Kilrush	...
,,	Ketton Hall [Stamford]	2·21	,,	Corofin	2·79
,,	Horncastle, Bucknall ...	1·79	XXI.	Carlow, Browne's Hill..	2·57
,,	Mansfield, Market Place	1·98	,,	Navan, Balrath	2·23
VIII.	Macclesfield, The Park.	1·05	,,	Athlone, Twyford	3·13
,,	Walton-on-the-Hill.....	·69	XXII.	Mullingar, Belvedere ...	2·08
,,	Lancaster, South Road.	1·26	,,	Clifden, Kylemore	4·80
,,	Broughton-in-Furness ..	...	,,	Crossmolina, Enniscoe..	3·09
IX.	Wakefield, Stanley Vic.	1·14	XXIII.	Carrick-on-Shannon ...	2·89
,,	Ripon, Mickley	1·38	,,	Dowra	...
,,	Scarborough.....	1·71	,,	Rockcorry.....	1·48
,,	East Layton [Darlington]	1·56	,,	Warrenpoint	2·22
,,	Middleton, Mickleton ..	1·29	,,	Newtownards	1·90
X.	Haltwhistle, Unthank..	1·44	,,	Belfast, New Barnsley .	2·55
,,	Shap, Copy Hill	2·95	,,	Bushmills	3·39
			,,	Buncrana	2·15

MAY, 1883.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1870–9	Greatest Fall in 24 hours. Dpth	Date.	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date.	Min. Deg	Date.	No. of Nights below 32°. In shade.	On grass.
			inches	inches.	in.								
I.	ENGLAND.	London (Camden Square) ...	1·97	+ ·05	·60	11	11	79·6	24	31·0	4	2	3
II.		Maidstone (Hunton Court)...	1·96	— ·06	·80	26	9	...	...	...	...	...	...
,,		Strathfield Turgiss	1·83	— ·15	·56	26	11	76·4	25	29·2	3	2	5
III.		Hitchin	1·73	— ·26	·55	26	10	73·0	25	27·0	3	2	...
,,		Banbury	1·62	— ·51	·34	26	15	76·0	24	28·0	4	2	...
IV.		Bury St. Edmunds (Culford)	1·18	— ·72	·39	26	10	85·0	24	27·0	4	2	..
,,		Norwich (Cossey)	1·05	— ·76	·25	26	10	82·0	24	32·0	4	1	1
V.		Bridport	1·69	...	·73	11	9	...	..	...	...	...	...
,,		Barnstaple.....	1·59	— ·51	·53	11	12	75·0	23	...	...	...	..
,,		Bodmin	2·19	— ·65	·68	11	14	73·0	19	32·0	8	1	6
VI.		Cirencester	1·55	— ·63	·41	25	9	..	...	...	...	...	...
,,		ChurchStretton(Woolstaston)	1·75	— ·64	·35	25	15	71·0	22	28·0	4	3	7
,,		Tenbury (Orleton)	1·20	— 1·23	·31	25	15	76·7	23	30·5	4	2	4
VII.		Leicester	2·26	...	·60	4	12	76·8	24	31·6	5	2	9
,,		Boston	2·48	+ ·71	·80	4	9	82·0	24	33·0	4	0	...
,,		Grimsby (Killingholme).....	1·76	+ ·11	·34	8	13	74·0	24	32·0	5	1	...
,,		Hesley Hall [Tickhill].....	...	...	...	...	...	...	...	...	...	...	...
VIII.		Manchester (Ardwick).....	·95	— 1·28	·25	12	10	75·0	25	35·0	4,5	0	...
IX.		Wetherby (Ribston Hall) ...	1·29	— ·53	·28	11	7	...	...	...	...	...	...
,,		Skipton (Arncliffe)	1·61	— 1·51	·47	7	14	72·0	16	32·0	11	1	...
X.		North Shields	1·72	— ·13	·49	7	12	74·2	24	31·0	7	1	1
,,		Borrowdale (Seathwaite).....	6·44	— ·54	2·68	28	12	...	...	...	...	...	...
XI.	WALES.	Cardiff (Ely).....	2·01	— ·59	·78	11	10	...	...	...	...	...	...
,,		Haverfordwest	2·04	— ·65	·80	12	11	69·0	16	31·9	3	1	8
,,		Plinlimmon (Cwmsymlog) ...	2·39	...	·46	28	10	...	...	...	..	...	...
,,		Llandudno.....	1·42	— ·20	·53	8	6	65·3	25	38·5	9	0	...
XII.	SCOTLAND.	Cargen [Dumfries]	1·97	— ·56	1·09	28	7	67·0	16	29·8	5	3	...
,,		Hawick	1·87	— ·27	·83	28	9	...	...	..	...	...	...
XIV.		Douglas Castle (Newmains)	1·63	— ·71	·68	28	11	...	...	...	...	...	...
XV.		Lochgilphead (Kilmory).....	...	...	...	...	...	...	...	...	...	...	...
,,		Appin (Airds)	3·42	...	...	..	...	...	...	..	...	...	.
,,		Mull (Quinish).....	3·20	...	·66	27	21	...	...	...	...	...	...
XVI.		Loch Leven Sluices	1·70	— ·59	·70	29	7	...	...	...	...	...	...
,,		Arbroath	1·35	— ·42	·22	25	11	67·0	24	33·0	6	0	...
XVII.		Braemar	1·85	— ·57	·26	31	20	64·8	23	31·0	8,9	5	20
,,		Aberdeen	·94	...	·13	25	18	73·0	24	32·0	5	1	...
XVIII		Skye (Sligachan)	10·89	...	2·50	28	17	...	...	...	...	...	...
,,		Culloden	1.22	— ·55	·40	31	5	66·0	25	33·8	4	0	10
XIX.		Dunrobin	2·14	...	·70	10	17	64·7	30	30·0	8	1	...
,,		Orkney (Sandwick)	2·94	+ 1·07	1·27	10	21	62·9	25	31·8	8	1	5
XX.	IRELAND.	Cork (Blackrock)	1·49	— ·67	·33	11	15	82·0	23	35·0	8, 10	0	...
,,		Dromore Castle	4·13	...	·80	28	12	71·0	16	33·0	8	0	...
,,		Waterford (Brook Lodge) ...	2·34	...	·62	7	13	70·7	17	32·0	11	1	...
,,		Killaloe	4·41	...	1·09	8	15	75·0	21	32·0	6,9	2	...
XXI.		Portarlington	1·99	+ ·14	·71	28	13	69·5	23	31·0	9	3	...
,,		Dublin (FitzWilliam Square)	2·02	+ ·30	1·39	8	13	68·8	23	35·4	11	0	0
XXII.		Ballinasloe	2·32	— .09	·58	25	15	64·0	16	31·0	10	1	...
XXIII.		Waringstown	1·62	— ·49	·41	28	14	72·0	22	30·0	9	3	6
,,		Londonderry (Creggan Res.).	2·31	...	·63	25	19	...	...	...	...	...	...
,,		Omagh (Edenfel)	1·67	— ·68	·52	25	24	66·0	27	31·0	9	1	3

+ Shows that the fall was above the average ; — that it was below it.

METEOROLOGICAL NOTES ON MAY.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain H for Hail; S for Snow.

ENGLAND.

STRATHFIELD TURGISS.—The weather of the month was perfect, and all growing crops improved in appearance; apple in flower on 1st, horse chestnut on 18th; elm in leaf on 6th, oak on 10th, ash on 16th; T on 25th.

BANBURY.—Very cold for the first 11 days, afterwards pleasant, and very favourable for field and garden; mean temp. 51°·1, rather below the average; high wind on 1st, 6th, and 12th; S on 4th, 5th, and 11th; T on 11th and 25th.

COSSEY.—The first 12 days were cold with E. or N.E. wind, after which the weather was warm and forcing; the 24th was very hot and dry, at 3 p.m. the dry bulb reading 80° and the wet 64°.

BODMIN.—A very genial month, and vegetation made wonderful progress; mean temp. 54°·4.

CIRENCESTER.—A dry month, with pleasant weather at the end.

WOOLSTASTON.—Mean temp. of the month, 50°·4. S on 4th and 5th.

ORLETON.—The first twelve days were cold, with a mean temp. about 5° below the average, and frosts on several nights; frequent light falls of R occurred, and a little S fell on 3rd. The remainder of the month was warm and pleasant, with much clear sunshine and temp. above the average. Mean temp. of the month about half a degree below the average; rainfall less than half the average. T and L on 26th.

LEICESTER.—The early part of the month was unsettled, with frequent rains sometimes heavy, but from the 12th to the end was very fine and seasonable, sometimes hot; a very refreshing rain occurred on 25th and 26th, and at the end of the month the country was looking very green and promising.

KILLINGHOLME.—The beginning of the month was cold and wet, the latter part dry and warm, and at the close showers were wanted for grass and spring corn. Distant T and L on 25th.

MANCHESTER.—A very fine dry month, but owing to the prevalence of E. wind the temp. was rather low for the season, especially in the early part. TS on 25th.

WALES.

HAVERFORDWEST.—Until the 7th cold bleak weather prevailed, with N.E. winds and low night temp., although only on one night did the temp. fall below 32°; from the 7th to the 12th the weather was wet, which did wonders for the grass and corn, and the remainder of the month was fine and bright, at times warm, with a fine dry bracing air. The whitethorn was in blossom as early as the 20th, a very unusual occurrence; the oak was in leaf before the ash. A friend of mine tells me that about the 27th the N. Wales highlands were to be seen from Fishguard and continued visible more than 48 hours, which is considered a certain indication of long drought. It was notably the case in 1859, when only 3·25 in. of R fell between April 8th and August 5th.

LLANDUDNO.—The mean temp was 2° below the average, and the range both diurnal and total was somewhat large; mean humidity about the average; duration of bright sunshine 214 hours; rain much wanted at the close of the month.

SCOTLAND.

CARGEN.—The first half of the month was unusually cold, with prevailing E. and N.E. winds. the latter half was milder, and vegetation, which had been unusually backward, made great progress; mean temp, 48°·9, 2°·1 below the average. The oak and ash came into leaf almost simultaneously towards the end of the month, an unusual occurrence, the oak being generally much the earlier.

HAWICK.—From the 2nd to the 11th the hills were white with S, and cold E. winds prevailed. Apple and pear trees are literally covered with blossom, and though vegetation was much retarded by the cold weather, the copious R on 27th and 28th made the country look most promising.

QUINISH.—A cold, ungenial month throughout.

ABERDEEN.—The weather was dry and breezy throughout the month, for although R fell on 18 days the quantity at any time was not great, and the total fall is about an inch below the average; S on 2nd and 8th.

SLIGACHAN.—The first ten days of the month were very cold and dry, and vegetation made little progress up to the middle of the month; very heavy R occurred on the night of the 27th, when 2·50 in. fell between 1 a.m and 8 a m.

SANDWICK.—May is generally our driest month, but it was not so this year, the total R being much above the average, and the fall on 10th (1·27 in.) such as seldom occurs here. The first part was rather cold, but the latter part became mild and sunny, so that vegetation made great progress.

IRELAND.

DROMORE CASTLE.—Cold nights hindered vegetation during the first half of the month, but during the last fortnight the temp. was high and equable, and the growth of all crops rapid.

WATERFORD.—S. to W. winds prevailed during the last ten days of the month; L and H on 2nd; T on 2nd, 25th and 26th; S on the Comeragh Mountains on 10th.

KILLALOE.—S began to fall on the night of the 8th, and continued without intermission until 2 p.m. on 9th, the entire surface of the ground being covered until late on the 10th; such a mid-winter visitation in May was never experienced here before.

DUBLIN.—Although a spell of severe cold for the time of year occurred early in the month, it was on the whole favourable from every point of view. There was an average mean temp. and rainfall, while the number of rainy days was slightly less than the average. In Dublin L was seen on 5th; solar halos on 4th, 18th, and 22nd; sleet and S fell on 8th; H on 3rd, 4th, and 5th; fogs occurred on 16th, 17th, and 22nd.

WARINGSTOWN.—The weather was cold for the first ten days, then genial, especially in the latter part; great promise of fruit, and everything making rapid progress.

EDENFEL.—The harsh character of the first half of the month was compensated by the copious showers and warm sunshine of the latter half. Vegetation at the end of the month was most luxuriant.

FRANCE AND TONQUIN.

WE are very glad to be able to announce that among the medical officers selected by the French Government to proceed with the expedition to Tonquin was Dr. Borius. Our readers will doubtless remember that we have been able to mention with considerable approval several works by Dr. Borius, the earlier ones on the climate of Senegal and other parts of tropical Western Africa, the later ones on that of Brest.

Dr. Borius received from the Bureau Central de Météorologie a good equipment of instruments, including recording barometer and thermometer, and sailed from Marseilles on the 29th of May.